but only what I estimate as about one-quarter of the insect families. As it should be, the insect families or other higher taxa that are included are generally the larger families and/or ones with conspicuous members. It is understandable that, if all the insect families were to be included, the book would be about twice the size. But, for example, for the orders Mecoptera and the Trichoptera, there are no family entries. For the Hymenoptera, to my count, there are 19 family entries, all being among the most common or speciose taxa (but still missing the Tenthridinidae, Pteromalidae, Proctotrupidae, Tiphiidae, and Megachilidae). Why the discrepancy between insects and fishes? Why couldn't the common scorpion flies (family Panorpidae) be included if the Kyphosidae (30 spp. marine perciform fishes) and the like were included? I suspect it is because Boxshall specializes in crustacean fish parasites.

For someone unable to afford volume two of the Synopsis and Classification of Living Organisms (treating the insect families of the world), it might be better still to save the money otherwise spent on the Illustrated Dictionary towards investing in that volume.—*David Grimaldi, Department of Entomology, The American Museum of Natural History, New York, New York 10024.*

INSECTS IN AGRICULTURAL COMMUNITIES

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The Entomology of Indigenous and Naturalized Systems in Agriculture.—Marvin K. Harris and Charlie E. Rogers (eds.). 1988. Westview Press, Boulder, Colorado, 238 pp. $35 paper.

Recent years have seen an increase in agricultural research into the philosophy and methods of traditional systems of crop production, with the aim of applying the lessons learned towards putting modern, large-scale agriculture on a more environmentally sound and sustainable footing (for a recent exposition, see M. A. Altieri's *Agroecology: The Scientific Basis of Alternative Agriculture,* Boulder, CO: Westview Press; 1987). *The Entomology of Indigenous and Naturalized Systems in Agriculture* is a collection of articles on research that continues in this vein. The book stems from the first two meetings of the Annual Robert H. Nelson Symposium on Crop Protection Entomology, sponsored by the Entomological Society of America. As outlined in the preface, its purpose is to highlight some agriculturally important plants and their associated arthropod communities from a biological, as well as an agricultural, perspective. The authors' task was to integrate the two perspectives as much as possible by emphasizing how the wild progenitors and relatives of present-day crop plants interacted with arthropods prior to, as well as after, plant domestication, and to suggest how this knowledge might be used in solving pest and other problems in agriculture and biology. The book thus serves to bring together the two approaches, one basic, the other applied, into a more or less unified whole, furthering efforts to place the study of agricultural systems more firmly within a proper ecological and evolutionary framework. While much attention has long been focused on exotic pests in agriculture (e.g., C. L. Wilson and C. L. Graham, eds. *Exotic Plant Pests*

tance, have not arisen. The entomology of cultivated strawberry, *Fragaria × ananassa,* is outlined in a short paper by Shanks and Sjulin. Little is known of the arthropods associated with wild strawberry. Of the major pests listed, few are restricted to strawberry. The potential for wild strawberry to serve as a source of genetic resistance to pests of the cultivated crop is emphasized. Payne, Horton, and Amis survey the arthropod complex of rabbiteye blueberries, *Vaccinium ashei.* Both reports in the literature and the experience of researchers in the field have fostered a perception that this species is relatively free of pest problems, although this will probably change as cultivated area increases. The major potential pests of rabbiteye and other blueberries are identified. The authors stress the need to develop timely pest management strategies to delay or prevent the advent of pest problems. This chapter falls somewhat short of the volume's stated purpose; there is little consideration of the big picture to relate the cultivated crop with its wild relatives and arthropod associates. The authors may not have had much to work with; apparently little is known of the arthropod complex in native *Vaccinium.*

Two chapters have to do with sorghum. In Chapter 6, Teetes discusses the role of johnsongrass, *Sorghum halepense,* an exotic, in influencing the dynamics of the sorghum midge, *Contarinia sorghicola,* the most serious insect pest of cultivated grain sorghum, *S. bicolor.* Initial domestication of grain sorghum dates from 3,000–4,000 B.C. in Africa; it was introduced into the U.S. during the slave-trade era. Johnsongrass was also purposely introduced into the U.S. southeastern and gulf regions in the 1830's for forage production, soon thereafter extending its range and becoming a pest (it is classified as one of the 10 worst weeds of field crops). The weed serves as a reservoir for *C. sorghicola* for the first two generations after emergence from larval diapause, allowing populations to build. Once early-planted sorghum has begun to flower, most midges disperse to the crop, and economic densities may soon be reached. In a reversal of the crop-weed-pest relationship as often viewed, johnsongrass constitutes the preferred host for the midge, while sorghum is relegated to the status of alternate host. Cultural insect controls are not always feasible. Crop protection has depended chiefly on insecticidal treatment, which is also of limited value. Teetes suggests, however, that the establishment of johnsongrass in crop environs may offer some good along with the bad, such as promoting genetic stability in pest populations, thus reducing the chances of biotype development. For this reason, not to mention the fact that it seems to be here to stay anyway, the author advises a kind of peaceful coexistence with the weed. Gilstrap (Chapter 7) describes a broader relationship, that of the sorghum-corn-wheat-johnsongrass association with Banks grass mite, *Oligonychus pratensis,* to argue that annual crops may provide the environmental stability necessary for effective use of biological controls. The importance specifically of johnsongrass in maintaining the stability of the system is again brought out, although much of the paper is concerned with reviewing work on conservation and augmentation of natural enemies within the crop itself.

Loevinsohn, Litsinger, and Heinrich's chapter on rice pests opens with a comparison of traditional and modern rice culture, including methods of insect control, in tropical Asia. There follows discussion of the impact, both favorable and unfavorable, of modern production practices (e.g., introducing resistant cultivars, chemical fertilization, and increasing cropping intensity) on pest populations, and how these practices might be modified to reduce crop losses. Much of the discussion is based on original data, here published for the first time.

In a comprehensive review that offers the reader an excellent short course in the production and entomology of wheat (*Triticum* spp.), a grain of premier importance in the global economy, Way surveys the range of insect pests of wheat from the different growing regions, with closer inspection made of the ecology of selected species. Major wheat pests, notably species of Aphididae and of various families of Diptera, but including a few other groups (e.g., cephid sawflies and chrysomelid beetles), tend to be oligophagous, associated with wild grasses. While the pests in western Europe appear to be indigenous, those in North America are primarily introduced species. The aphids are given especial attention. About 10 species are considered direct pests of wheat, including the Russian wheat aphid, *Diuraphis noxia,* the distribution of which should be amended in the author's list now to include North America (see M. B. Stoetzel. *J. Econ. Entomol.* 80(3):696–704; 1987). In areas, such as North America, where relatively low yields render chemical controls uneconomical, cultural controls and host plant resistance are potentially powerful techniques for wheat pest control.

The final chapter, by Harris, concerns arthropods of pecan (*Carya illinoensis*), a tree crop native to North America, and one in which a high percentage of production stems from naturally growing, wild trees. Unlike many other crops, for which the newest production methods and most improved varieties tend to be adopted universally by growers, the peculiar nature of pecan culture, involving the long association of a native plant with a native complex of arthropods, permits a rare glimpse of how the process of plant domestication affects an associated fauna; a range of ecological situations, from essentially undisturbed to intensively managed orchards, is available for study. Pecan thus offers something of interest for both the basic and the applied scientist. Only two species of nut feeders, of a fairly extensive arthropod complex, are of consistent, economic concern: the pecan nut casebearer, *Acrobasis nuxvorella* (a pyralid) and the pecan weevil, *Curculio caryae.* The phenomenon of masting, the synchronized production of nuts on alternate years over a broad geographic region, has generally been a major factor limiting pest abundance in pecan. This trait, together with the genetic diversity within orchards supplied by wild trees, is given credit for the infrequency of pest outbreaks. However, new tree varieties that yield every year now are necessitating the increased use of insecticides.

A common thread running through the chapters of this book is the recognition of the importance of natural vegetation in the life-ways of agriculturally important arthropods. The wild relatives of crops may be detrimental (as reservoirs of pests and pathogens) or beneficial (as sources of resistant germplasm or refuges for natural enemies) in the larger ecosystem of which the crop is a part, and it is within this context that strategies for pest control are most rationally considered and implemented. The doubtful utility of insecticides as a viable means of control is stressed repeatedly. In sentiments voiced at his chapter's, and the book's, end, Harris expresses well the theme of this volume: that the defensive mechanisms we have inherited from nature can be of greater value in the profit-driven environment of commercial crop production if only we develop a better understanding of them and how they can be exploited.

The Entomology of Indigenous and Naturalized Systems in Agriculture is, on the whole, an excellent reference source. Most of the chapters include tabulated summaries of pests and crop information accompanied by discussions of the biology and economic importance of each major pest species. Many include an extensive reference list, allowing the reader entry into, or review of, the significant literature of a subject area. The papers by Rogers, Finch, and Way are particularly interesting and informative, and undoubtedly will be cited in future work in their areas. Author names are thoroughly indexed, but a rather brief subject index may reduce somewhat the reference value of the book. The book does suffer from the usual minor typographical errors, inaccuracies, and lapses: a proper noun uncapitalized here, a scientific name misspelled there, a technical term used inappropriately, and the occasional, inadvertent abuse of the Queen's English somewhere else. These flaws are largely attributable to the format in which the book was produced, with chapters in the form of camera-ready, original typescripts. Physically, the book is well wrought. It is printed on acid-free paper and bound in soft covers, and would seem able to withstand long, if careful, use. The $35 price is, one supposes, about par for the course for "paperbacks" published for a limited, professional readership. The book will be of particular interest to every ecologically minded agricultural entomologist. It is further recommended as a supplementary text for courses in agricultural science, economic entomology, and seminars in insect pest management.—*Thomas W. Culliney, USDA Forest Service, Northeastern Forest Experiment Station, Center for Biological Control, 51 Mill Pond Road, Hamden, Connecticut 06514.*